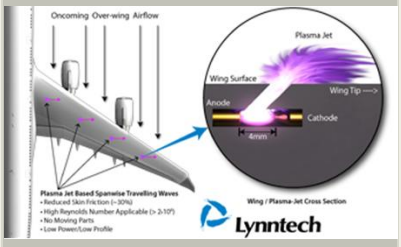
Drag Reduction through Pulsed Plasma Actuators, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

Drag reduction is a fundamental necessity in all aerodynamic designs, as it directly affects aircraft fuel efficiency which in turn affects endurance, range, and flight speed. Skin-friction drag reduction technology has a very significant impact in the future design of all aircraft, propellers, turbine blades, and wind-turbines, just to name few applications. Experimental and Direct Numerical Simulations results provide evidence that spanwise waves, of appropriate frequency and amplitude in the turbulent boundary layer, produce substantial skin-friction drag reduction. The generation and control of the spanwise waves however has been a significant practical barrier to the implementation of this technology, due to the requirement for complex moving parts that are too heavy and expensive to be added to an aircraft wing. In fact their additional weight and complex installation would essentially reduce or negate the benefits of the drag reduction. Lynntech proposes to use a proprietary technology based on Pulsed Plasma actuators, which are light-weight, simple to build, and easy to control, to generate turbulent boundary layer perturbations that induce significant skin-friction drag reduction. The proposed technology can be embedded in the wing, or propeller blade, to be flush with the wall and be electrically powered, thus avoiding additional ducting and other adverse characteristics that make competing skin-friction drag reduction approaches impractical for aeronautical applications. Lynntech's approach could also be exploited for dual use: the plasma actuators, in a different flight regime, could also be used to delay flow separation and thus delay stall onset, without the need to install an additional system. The proposed technology has a very wide outreach because it addresses a fundamental issue in aerodynamics and could be applied equally well to increase efficiency of aircraft within NASA programs, civilian transport aircraft, and military vehicles.



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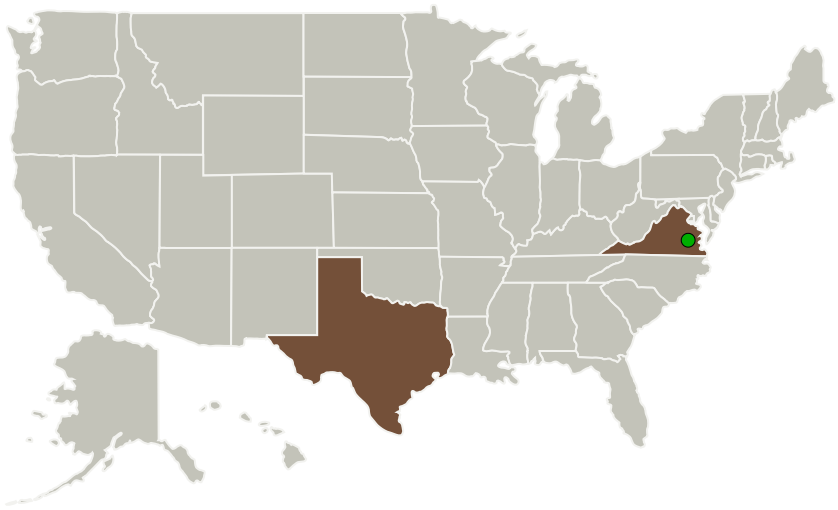
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Lynntech, Inc.	Lead Organization	Industry	College Station, Texas
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Texas	Virginia

Project Transitions

June 2015: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Lynntech, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

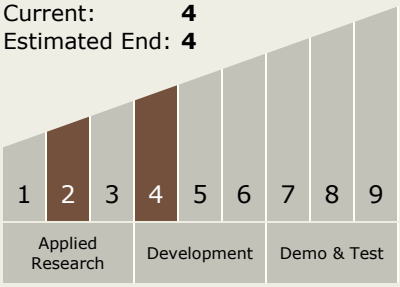
Carlos Torrez

Principal Investigator:

Ashwin Balasubramanian

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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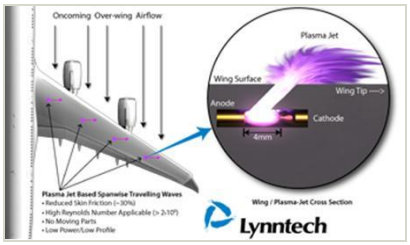
December 2015: Closed out

Closeout Summary: Drag Reduction through Pulsed Plasma Actuators, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138946)*

Images



Briefing Chart Image
Drag Reduction through Pulsed Plasma Actuators, Phase I *(https://techport.nasa.gov/image/136612)*

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.5 Propulsion Flowpath and Interactions

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System